

APPENDIX A.—ASSUMPTIONS AND METHODS UNDERLYING THE MEDIUM-RANGE AND LONG-RANGE COST ESTIMATES

This appendix describes the assumptions and methods which underlie the medium-range and long-range cost estimates in this report. All descriptions pertain to the estimates under each of the four alternatives unless specifically stated otherwise. The basic assumptions comprising each alternative have been summarized in an earlier section entitled "Economic and Demographic Assumptions" and thus will be discussed here only in the context of the methods used. Further details about the assumptions, methods, and cost estimates are published periodically in Actuarial Studies prepared by the Office of the Actuary, Social Security Administration.

TOTAL POPULATION

Projections were made of the U.S. population (including persons overseas covered by the OASDI program) by age, sex, and marital status for future years to 2060. The starting point was the population on July 1, 1979 as estimated by the Bureau of the Census from the 1970 Census and from births, deaths, and net immigration during 1970-79. This population estimate was adjusted for net census undercount and was increased by the estimated populations in the geographic areas covered by the OASDI program but not included in the estimate made by the Bureau of the Census. The population in future years was then projected from assumed rates of birth and death and assumed net immigration.

Historically, fertility rates in the United States have fluctuated widely. The total fertility rate (which for any year is the average number of children who would be born to a woman in her lifetime if she were to experience the birth rates by age observed in (or assumed for) the selected year and if she were to survive the entire childbearing period) decreased from 3.3 after World War I to 2.1 during the Great Depression, rose to about 3.7 in 1957 and then fell to 1.7 in 1976. Since that time, the total fertility rate has fluctuated around 1.8 children per woman.

The historical variations in fertility rates have resulted from changes in social attitudes, economic conditions, and medical knowledge. After considering the recent behavior and trends of these factors, ultimate total fertility rates of 2.4, 2.1, 2.1, and 1.7 children per woman were selected for alternatives I, II-A, II-B, and III, respectively. For each alternative, the total fertility rate was projected from its estimated level in 1980 to its ultimate level in 2005 by linear interpolation. These ultimate values can be compared with those used by the Bureau of the Census in its latest series of population projections.¹ The Bureau of the Census used a range of 1.7 to 2.7, with an intermediate assumption of 2.1, as is used in alternatives II-A and II-B. This rate of 2.1 is the rate which would result in a constant population if there were no net migration and if mortality were constant at levels close to current U.S. levels.

Historically, mortality rates in the United States have improved steadily. The age-adjusted death rate—which for any year is the crude rate that would occur in the enumerated total population as of April 1,

¹U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 704, "Projections of the Population of the United States: 1977-2050," U.S. Government Printing Office, Washington, D.C., 1977.

1970, if that population were to experience the death rates by age for the selected year—has been improving an average of 1.2 percent per year since 1900. The historical improvement in mortality rates has resulted from many factors, including increased medical knowledge, increased availability of health-care services, and improvements in personal health-care practices such as diet and exercise. The mortality assumptions in alternatives II-A and II-B (which are identical) were developed after taking these factors into consideration. First, ultimate percentage improvements in death rates by sex and cause of death were selected. Then the annual percentage improvements by age, sex, and cause of death were projected by a logarithmic formula from their average values during 1968-78 to their ultimate values in 2005. The resulting average annual improvement in the age-adjusted death rate during 1978-2060 is 0.57 percent, or about 48 percent of the observed average annual improvement during 1900-78. The mortality assumptions in alternative I reflect average annual improvements in the death rates by age and sex of half as much as those in alternatives II-A and II-B, while in alternative III they are twice as much.

Net immigration was assumed to be 400,000 persons per year in all four alternatives. The assumed net immigration does not include aliens entering the United States illegally, largely because no reliable estimate of their number exists. However, illegal aliens as enumerated in the 1970 Census were included in the starting population.

Table A1 shows the projected population by broad age groups under all four alternatives. Because many categories of OASDI benefits depend upon marital status, the population was also projected by marital status in addition to age and sex. Marriage rates and divorce rates were based on recent data from the National Center for Health Statistics.

TABLE A1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1960-2060

Calendar year	Population (in thousands)			Total	Dependency ratio	
	Under 20	20-64	65 and over		Aged ¹	Total ²
1960	73,116	98,687	17,146	188,949	0.174	0.915
1965	79,931	104,112	18,963	203,006	.182	.950
1970	80,637	112,500	20,655	213,792	.184	.900
1975	77,947	122,036	23,092	223,075	.189	.828
1976	77,039	124,145	23,635	224,818	.190	.811
1977	76,420	126,200	24,166	226,787	.191	.797
1978	75,545	128,416	24,724	228,685	.193	.781
1979	74,734	130,579	25,328	230,640	.194	.766
1980	74,045	132,731	25,892	232,668	.195	.753
Alternative I:						
1985	72,544	142,471	28,638	243,653	.201	.710
1990	74,692	148,834	31,599	255,125	.212	.714
1995	78,055	154,233	33,712	266,001	.219	.725
2000	81,414	160,063	34,651	276,127	.216	.725
2005	83,580	167,312	35,578	286,470	.213	.712
2010	86,178	173,139	38,171	297,488	.220	.718
2015	89,789	175,977	42,975	308,741	.244	.754
2020	94,000	176,948	48,767	319,715	.276	.807
2025	97,720	177,582	54,917	330,220	.309	.860
2030	100,879	180,157	59,479	340,514	.330	.890
2035	104,208	185,911	60,211	350,891	.327	.887
2040	108,086	193,160	60,211	361,457	.312	.871
2045	112,347	200,747	59,218	372,312	.295	.855
2050	116,557	207,264	59,915	383,735	.289	.851
2055	120,567	214,037	61,497	396,101	.287	.851
2060	124,619	221,831	63,166	409,616	.285	.847

TABLE A1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1960-2060 (Cont.)

Calendar year	Population (in thousands)			Dependency ratio		
	Under 20	20-64	65 and over	Total	Aged ¹	Total ²
Alternatives II-A and II-B:						
1985	72,252	142,531	28,773	243,556	.202	.709
1990	73,529	149,044	32,106	254,678	.215	.709
1995	75,506	154,640	34,745	264,891	.225	.713
2000	77,001	160,695	36,251	273,947	.226	.705
2005	76,957	167,890	37,719	282,566	.225	.683
2010	77,273	173,062	40,846	291,182	.226	.683
2015	78,570	174,678	46,225	299,473	.265	.714
2020	80,376	173,902	52,653	306,931	.303	.765
2025	81,720	172,107	59,539	313,366	.346	.821
2030	82,453	171,598	64,925	318,977	.378	.859
2035	83,151	173,803	67,044	323,997	.386	.864
2040	84,235	177,012	67,257	328,504	.380	.856
2045	85,604	180,037	66,922	332,562	.372	.847
2050	86,889	181,582	67,942	336,412	.374	.853
2055	87,921	183,192	69,293	340,406	.378	.858
2060	88,862	185,627	70,327	344,816	.379	.858
Alternative III:						
1985	71,868	142,644	29,033	243,545	.204	.707
1990	71,993	149,425	33,080	254,498	.221	.703
1995	72,129	155,355	36,747	264,231	.237	.701
2000	71,141	161,776	39,409	272,327	.244	.683
2005	68,182	168,966	42,034	279,181	.249	.652
2010	65,598	173,318	46,337	285,252	.267	.646
2015	64,138	173,331	52,970	290,439	.306	.676
2020	63,283	170,229	60,755	294,268	.357	.729
2025	62,211	165,202	69,170	296,584	.419	.795
2030	60,641	160,684	76,250	297,575	.475	.852
2035	58,922	158,429	80,126	297,477	.506	.878
2040	57,538	156,715	82,119	296,372	.524	.891
2045	56,488	154,324	83,473	294,285	.541	.907
2050	55,486	150,147	85,728	291,361	.571	.941
2055	54,347	146,106	87,430	287,883	.598	.970
2060	53,134	142,999	88,048	284,181	.616	.987

¹Population aged 65 and over as ratio to population aged 20-64.

²Population aged 65 and over plus population under age 20 as ratio to population aged 20-64.

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text.

A more thorough discussion of the population projections is shown in an Actuarial Study published by the Social Security Administration.¹

COVERED POPULATION

The number of persons who work in covered employment at any time during a calendar year is referred to as the number of covered workers for that year. Projections of the number of covered workers were made by applying projected coverage rates by age and sex to the corresponding number of people in the total population. The coverage rates—i.e., the percentages of the total population who work in covered employment during the year—were projected by age and sex from projected labor force participation rates and unemployment rates, based on the relationships that existed among those rates from the 1950's through 1977.

Labor force participation rates were projected by age and sex. The procedure takes into account projections of the percentage of the population that is married or disabled, the number of children in the population, and the state of the economy. In addition, recent trends in the labor force participation rates, which cannot be fully explained by the above factors (such as the increases in the rate for women), were

¹Joseph F. Faber and John C. Wilkin, F.S.A., *Social Security Area Population Projections, 1981*, Actuarial Study No. 85 (U.S. Department of Health and Human Services, SSA Publication No. 11-11532, July 1981).

assumed to continue for several more years before tapering off to zero by the year 2000. All of these factors vary by alternative. For men, the resulting age-adjusted labor force participation rates projected under alternatives I and II-A for 2060 are, respectively, 1.9 and 0.3 percentage points higher than the 1981 level of 77.7 percent, while those for alternatives II-B and III are 0.3 and 2.1 percentage points lower. For women, the age-adjusted labor force participation rates were projected to increase under all of the alternatives. The resulting rates for 2060 are 9.4, 8.9, 7.7, and 7.4 percentage points above the 1981 level of 52.0 percent.

The total age-sex-adjusted unemployment rate has averaged 5.2 percent over the last 30 years and 6.2 percent over the last 10 years. The ultimate total age-sex-adjusted unemployment rates were assumed to be 4.0, 5.0, 5.0, and 6.0 percent in alternatives I, II-A, II-B, and III, respectively. In each alternative the unemployment rates are assumed to decline gradually, reaching their ultimate levels by the mid-1990's.

The resulting age-adjusted coverage rate for men was projected to change from its 1981 level of 74.8 percent to 77.0, 75.1, 74.5, and 72.5 percent in 2060 under alternatives I, II-A, II-B, and III, respectively. Correspondingly, for women, it was projected to increase from its 1981 level of 54.3 percent to 66.0, 64.8, 63.6, and 62.6 percent.

TAXABLE PAYROLL

The taxable payroll is defined as that amount which, when multiplied by the combined employee-employer tax rate, yields the total amount of taxes paid by employees, employers, and the self-employed. When the cost of the OASDI program is expressed as a percentage of taxable payroll—that is, as a cost rate—it can be compared directly with the combined OASDI employee-employer tax rate to determine whether the system is operating at a surplus or deficit.

In practice, the taxable payroll is calculated as a weighted average of the earnings on which employees, employers, and self-employed persons are taxed. The weighting takes into account the lower tax rates on self-employment income, on tips, and on multiple-employer "excess wages," as compared with the combined employee-employer rate. For 1982-91, the amounts of earnings for employees, employers, and the self-employed were projected separately. After 1991, the amounts of earnings taxable for employees, employers, and the self-employed were each assumed to increase at the compounded rate of the estimated increases in covered workers and in average wages in covered employment.

Another way to measure the cost of the program is as a percentage of the Gross National Product (GNP). Such percentages (which are shown in Table 30) are based on the estimated cost rates and on the assumed ratios of taxable payroll to GNP which are presented in Table A2. The GNP series was determined by applying a series of factors to the assumed ratio of total employee compensation in the economy to GNP. The ratio of total employee compensation in the economy to GNP was used as the initial point because it is a measure of the share of output going to workers. This ratio is also a convenient starting point because it has changed slowly over time and can be expected to remain fairly constant. Total employee compensation in the economy was related to

taxable payroll by means of factors which adjust for various differences in the two measures. The factors adjust total employee compensation by removing supplements to wages and salaries; removing wages and salaries earned in noncovered employment; removing wages, salaries, and self-employment income earned above the taxable base; and adjusting for the lower tax rates on self-employment income, on tips, and on multiple-employer "excess wages."

The ratio of taxable payroll to GNP has risen since 1960, in part because of the increases made in the contribution and benefit base. The long-range trend, however, is more likely to be downward because of increases in forms of employee compensation other than wages that are, therefore, not included in taxable payroll. These forms of compensation, which the government encourages by affording them favorable tax treatment, include many forms of fringe benefits, both public and private. The ratio of wages to total employee compensation is assumed to decline ultimately by 0.2, 0.3, 0.4, and 0.5 percent per year under alternatives I, II-A, II-B, and III, respectively. This ratio has declined at an average annual rate of 0.42 percent over the last 30 years and 0.65 percent over the last 10 years.

TABLE A2.—RATIO OF TAXABLE PAYROLL TO GNP BY ALTERNATIVE, CALENDAR YEARS 1960-2060

Calendar year	Past experience			
1960	0.330			
1965 .....	.350			
1970 .....	.407			
1975 .....	.419			
1980 .....	.436			
	Projected, by alternative			
	I	II-A	II-B	III
1982	0.439	0.442	0.439	0.439
1985 .....	.439	.427	.432	.426
1990 .....	.440	.427	.425	.419
1995 .....	.438	.420	.417	.410
2000 .....	.431	.412	.406	.402
2005 .....	.426	.405	.399	.392
2010 .....	.422	.400	.391	.383
2015 .....	.418	.394	.384	.374
2020 .....	.414	.388	.376	.365
2025 .....	.410	.383	.369	.356
2030 .....	.406	.377	.362	.348
2035 .....	.402	.372	.356	.340
2040 .....	.398	.367	.349	.332
2045 .....	.394	.362	.342	.324
2050 .....	.391	.356	.336	.316
2055 .....	.387	.351	.330	.309
2060 .....	.383	.346	.323	.302

Note: The definitions of alternatives I, II-A, II-B, and III and taxable payroll are presented in the text.

INSURED POPULATION

There are three types of insured statuses under the OASDI program: fully, currently, and disability insured. Fully insured status is required of an aged worker for eligibility for a primary retirement benefit and for the eligibility of other persons to auxiliary benefits based on the worker's earnings. Fully insured status is also required of a deceased worker for survivors' eligibility for benefits (with the exception of child survivors and parents of eligible child survivors, who may alternatively be eligible if the deceased worker had currently insured status). Disability insured

status, which is more restrictive than fully insured status, is required of a disabled worker for eligibility for a primary benefit and for the eligibility of other persons to auxiliary benefits based on the worker's earnings.

Projections of the percentage of the population which is fully insured were made by age and sex based on past and projected coverage rates, the requirement for fully insured status, and the historical relationship between these factors. Currently insured status was disregarded in the cost projection, because the number of cases in which eligibility for benefits is based solely on currently insured status is relatively small. Projections of the percentage of the population that is disability insured were developed from the percentages of those who are fully insured by using projections of historical trends relating the two. Finally, the fully insured and disability insured populations were developed from the projected total population by applying the percentages fully insured and disability insured.

The fully insured population by age and sex was further subdivided by marital status, in a manner consistent with the division of the total population by marital status. Married men were assumed to be more likely to be fully insured than widowers who were, in turn, assumed more likely than single and divorced men. By contrast, single and divorced women were assumed to be more likely to be fully insured than widows who were, in turn, assumed more likely than married women. The relative difference between a widowed woman's probability of being fully insured and a married woman's was assumed to decrease through time, reflecting the projected large increase in labor force participation among married women.

OLD-AGE AND SURVIVORS INSURANCE BENEFICIARIES

Several types of benefits, at different benefit levels, are payable under the OASI program. Hence, the numbers of beneficiaries were projected by type of benefit.

The projected numbers of retired-worker beneficiaries were based on the projected aged fully insured population. The percentages, by age and sex, of the insured population which were receiving benefits at the beginning of 1982 were projected to increase slightly on the basis of past trends with adjustments for changes in the earnings test, the mandatory retirement age, unemployment levels, and benefit replacement rates.

The number of wife beneficiaries aged 62 and over of retired-worker beneficiaries was estimated from the population projection by marital and insured status. All uninsured wives aged 62 and over—excluding those whose husbands do not receive retired-worker benefits, those whose benefits are withheld according to the earnings test, and those affected by eligibility for a government pension from earnings in noncovered employment—were assumed to receive benefits. The number of husband beneficiaries aged 62 and over of retired-worker beneficiaries was estimated in an analogous manner.

The projected numbers of child beneficiaries of retired-worker beneficiaries were based on projected ratios of the number of such child beneficiaries to the number of retired workers by sex of worker, adjusted to reflect the fertility assumptions.

The number of young-wife beneficiaries was estimated by extrapolating the base-year ratio of the number of such beneficiaries to the estimated number of child beneficiaries who are children of male retired-worker beneficiaries, and are either under age 16 or disabled with onset of disability before age 16. The estimating procedure takes into account projected changes in fertility and female labor force participation. The number of young-husband beneficiaries was not projected because of the negligible cost attributable to them.

The number of widow beneficiaries aged 60 and over was estimated from the population by marital and insured status. All uninsured widows aged 60 and over, excluding those whose deceased husbands were not fully insured, those withheld according to the earnings test, and those affected by eligibility for a government pension from earnings in noncovered employment, were assumed to receive benefits. In addition, some insured widows who had not applied for retired-worker benefits were assumed to receive widow benefits. The number of widower beneficiaries was estimated in an analogous manner.

The numbers of paternal, maternal, and full orphans under age 22 in the United States were estimated from the projected population at those ages by applying age-specific probabilities of being an orphan. These probabilities were derived by using distributions of age of parent at birth of child and death rates consistent with the population projections. To estimate the number of child-survivor beneficiaries, the number of orphans was adjusted to include eligible disabled orphans aged 18 and over and to eliminate orphans of uninsured deceased parents. For nondisabled children aged 18-21, a further reduction was made to exclude those not attending school.

The number of mother beneficiaries was estimated by a method similar to the one used to estimate the number of young-wife beneficiaries—i.e., extrapolating the present ratio of such beneficiaries to child-survivor beneficiaries who are either under age 16 or disabled with onset of disability before age 16. The number of father beneficiaries was estimated in an analogous manner.

The number of parent beneficiaries was projected on the basis of the past trend in the number of such beneficiaries. A decrease was assumed from 14,000 in the middle of 1981 to an ultimate level of 7,000 in 1995.

Table A3 shows the estimated numbers of beneficiaries under the OASI program. Included among the beneficiaries who receive retired-worker benefits are some persons who also receive residual benefits consisting of the excess of any potential auxiliary benefits over their own retired-worker benefit. Estimates of the number of such residual payments were made separately for wives, widows, husbands, and widowers. Residual payments to other beneficiaries were not taken into account, because of the negligible cost involved.

TABLE A3.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 BY ALTERNATIVE, CALENDAR YEARS 1960-2060
[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
1960.....	7,813	2,224	260	1,471	388	1,549	35	13,740
1965.....	10,843	2,601	429	2,228	472	1,900	36	18,509
1970.....	13,066	2,651	535	3,151	514	2,673	29	22,618
1975.....	16,210	2,836	633	3,823	588	2,905	22	26,998
1976.....	16,789	2,867	638	3,939	576	2,911	21	27,740
1977.....	17,380	2,899	670	4,042	573	2,843	19	28,428
1978.....	17,924	2,942	662	4,147	569	2,800	18	29,062
1979.....	18,590	2,966	651	4,260	567	2,739	17	29,789
1980.....	19,167	2,987	633	4,354	560	2,668	15	30,384
1981.....	19,792	3,010	639	4,446	549	2,624	14	31,074
Alternative I:								
1982.....	20,325	2,999	623	4,538	497	2,482	13	31,476
1985.....	22,200	3,058	538	4,747	412	2,062	10	33,028
1990.....	24,954	3,155	542	5,079	426	1,905	8	36,069
1995.....	26,646	3,173	483	4,829	467	2,004	7	37,609
2000.....	27,750	3,077	484	4,701	488	2,078	7	38,585
2005.....	29,357	3,025	509	4,579	486	2,104	7	40,066
2010.....	32,506	3,063	576	4,468	482	2,132	7	43,234
2015.....	37,446	3,200	673	4,437	488	2,198	7	48,449
2020.....	43,221	3,447	769	4,473	494	2,297	7	54,608
2025.....	49,019	3,446	844	4,593	491	2,382	7	60,782
2030.....	52,796	3,381	856	4,672	492	2,443	7	64,647
2035.....	54,298	3,202	833	4,709	506	2,503	7	66,058
2040.....	53,983	3,006	800	4,679	528	2,584	7	65,587
2045.....	53,892	2,895	807	4,616	549	2,686	7	65,452
2050.....	54,913	2,912	848	4,526	566	2,782	7	66,554
2055.....	56,410	3,017	886	4,493	580	2,865	7	68,258
2060.....	57,897	3,109	906	4,506	600	2,949	7	69,974
Alternative II-A:								
1982.....	20,328	3,000	623	4,542	497	2,480	13	31,482
1985.....	22,248	3,065	537	4,786	410	2,049	10	33,106
1990.....	25,243	3,192	540	5,188	414	1,847	8	36,431
1995.....	27,394	3,306	493	4,918	438	1,854	7	38,410
2000.....	28,930	3,275	503	4,831	443	1,834	7	39,823
2005.....	30,958	3,271	532	4,750	435	1,792	7	41,745
2010.....	34,534	3,369	602	4,674	430	1,762	7	45,376
2015.....	39,946	3,565	708	4,645	433	1,766	7	51,070
2020.....	46,267	3,774	811	4,702	434	1,794	7	57,789
2025.....	52,720	3,916	892	4,804	424	1,815	7	64,578
2030.....	57,226	3,898	912	4,906	419	1,820	7	69,188
2035.....	59,466	3,742	893	4,976	420	1,813	7	71,317
2040.....	59,848	3,537	862	4,993	428	1,822	7	71,497
2045.....	60,354	3,414	874	4,966	433	1,845	7	71,893
2050.....	61,566	3,403	910	4,895	434	1,864	7	73,079
2055.....	62,821	3,462	937	4,839	436	1,876	7	74,378
2060.....	63,690	3,501	940	4,798	439	1,883	7	75,258
Alternative II-B:								
1982.....	20,328	3,000	623	4,542	497	2,480	13	31,483
1985.....	22,248	3,065	537	4,786	410	2,049	10	33,106
1990.....	25,240	3,191	540	5,188	414	1,847	8	36,428
1995.....	27,382	3,314	493	4,920	438	1,854	7	38,408
2000.....	28,904	3,285	503	4,839	443	1,833	7	39,814
2005.....	30,915	3,288	532	4,757	435	1,791	7	41,725
2010.....	34,478	3,393	602	4,689	430	1,760	7	45,359
2015.....	39,882	3,594	708	4,662	433	1,762	7	51,048
2020.....	46,187	3,803	808	4,722	433	1,793	7	57,753
2025.....	52,603	3,972	892	4,831	424	1,813	7	64,542
2030.....	57,102	3,948	912	4,936	418	1,815	7	69,138
2035.....	59,319	3,801	893	5,024	420	1,813	7	71,277
2040.....	59,692	3,597	860	5,034	428	1,822	7	71,440
2045.....	60,188	3,468	872	5,018	432	1,839	7	71,824
2050.....	61,394	3,375	910	4,951	434	1,863	7	73,034
2055.....	62,637	3,526	936	4,898	435	1,874	7	74,313
2060.....	63,521	3,570	940	4,858	438	1,881	7	75,215

TABLE A3.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 BY ALTERNATIVE, CALENDAR YEARS 1960-2060 (Cont.)
[In thousands]

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Alternative III:								
1982	20,336	3,001	623	4,551	496	2,476	13	31,496
1985	22,338	3,079	537	4,861	405	2,025	10	33,255
1990	25,782	3,261	539	5,400	392	1,744	8	37,125
1995	28,851	3,559	513	5,082	388	1,613	7	40,013
2000	31,270	3,653	534	5,095	375	1,481	7	42,415
2005	34,188	3,761	569	5,114	360	1,361	7	45,360
2010	38,713	3,963	655	5,113	352	1,277	7	50,080
2015	45,144	4,272	773	5,155	353	1,230	7	56,934
2020	52,610	4,597	891	5,256	349	1,203	7	64,913
2025	60,385	4,859	986	5,408	337	1,172	7	73,154
2030	66,371	4,915	1,018	5,562	323	1,131	7	79,327
2035	70,191	4,811	1,008	5,711	316	1,089	7	83,133
2040	72,170	4,610	983	5,812	311	1,052	7	84,945
2045	74,166	4,455	998	5,917	301	1,022	7	86,866
2050	76,346	4,376	1,032	5,977	291	993	7	89,022
2055	77,792	4,303	1,040	6,011	281	964	7	90,398
2060	78,237	4,173	1,025	6,027	271	932	7	90,672

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text. The numbers of beneficiaries do not include certain uninsured persons aged 72 and over with less than 3 quarters of coverage, the costs for whom are reimbursable to the OASI Trust Fund by the general fund of the Treasury. The number of such persons is estimated to be 69,500 as of June 30, 1982, and less than 1,000 by the turn of the century. Totals do not necessarily equal the sum of the rounded components.

DISABILITY INSURANCE BENEFICIARIES

The number of disabled-worker beneficiaries was projected from the exposed population, which was developed from the disability insured population by removing those persons already entitled to disabled-worker benefits. The number of newly entitled beneficiaries was developed from the exposed population by applying disability incidence rates. To obtain the number of currently entitled beneficiaries, termination rates were applied to the population consisting of the newly entitled beneficiaries and those already currently entitled.

In alternatives II-A and II-B, disability incidence rates, which declined during 1978-81, are assumed to reach a minimum in 1982 and then to increase steadily through 2001, when they reach an ultimate level which is about 15 percent higher than the average incidence rate for 1979-81. In alternatives I and III, the disability incidence rates follow patterns similar to the one in alternatives II-A and II-B except that the ultimate levels are different. In alternatives I and III, the rates reach ultimate values that are the same as the average for 1979-81 and 30 percent higher, respectively.

The termination rates were estimated by age, sex, and duration of entitlement. The mortality rates used throughout the projection period were assumed to be the same as those experienced by disabled-worker beneficiaries during 1976-79. The recovery rates were assumed to be 20 percent higher than those of the same period, thereby allowing for the assumed effect of the Disability Amendments of 1980. All disabled-worker benefits terminate at age 65, when retired-worker benefits become payable.

The number of children entitled to benefits was projected as a proportion of the number of disabled-worker beneficiaries, by sex, based on recent experience and allowing for projected changes in fertility.

The number of young-wife beneficiaries was estimated by extrapolating the base-year ratio of the number of such beneficiaries to the estimated number of child beneficiaries who are children of male disabled-worker beneficiaries and are either under age 16 or disabled with onset of disability before age 16. The estimating procedure takes into account projected changes in fertility and female labor force participation. The number of young-husband beneficiaries was projected in an analogous manner.

The number of aged-wife beneficiaries was projected as a proportion of the number of male disabled-worker beneficiaries. The number of aged-husband beneficiaries was projected in an analogous manner.

Table A4 shows the projected number of beneficiaries in the DI program.

TABLE A4.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 BY ALTERNATIVE, CALENDAR YEARS 1960-2060
(In thousands)

Calendar year	Disabled workers	Dependents of disabled workers			Total
		Wives and husbands	Children		
1960.....	371	56	94	522	
1965.....	944	187	518	1,648	
1970.....	1,436	271	861	2,568	
1975.....	2,363	429	1,333	4,125	
1976.....	2,602	468	1,462	4,533	
1977.....	2,755	482	1,496	4,733	
1978.....	2,858	491	1,512	4,861	
1979.....	2,877	483	1,466	4,826	
1980.....	2,863	468	1,403	4,734	
1981.....	2,835	450	1,350	4,636	
Alternative I:					
1982.....	2,721	417	1,231	4,370	
1985.....	2,583	363	1,100	4,047	
1990.....	2,690	338	1,025	4,053	
1995.....	2,820	353	1,076	4,249	
2000.....	3,197	393	1,213	4,803	
2005.....	3,695	447	1,364	5,506	
2010.....	4,134	494	1,511	6,140	
2015.....	4,393	521	1,639	6,552	
2020.....	4,465	527	1,730	6,722	
2025.....	4,355	512	1,745	6,612	
2030.....	4,201	492	1,710	6,404	
2035.....	4,211	493	1,715	6,419	
2040.....	4,384	513	1,782	6,679	
2045.....	4,623	541	1,880	7,045	
2050.....	4,777	559	1,952	7,289	
2055.....	4,881	571	1,998	7,451	
2060.....	5,033	589	2,054	7,676	
Alternative II-A:					
1982.....	2,724	418	1,233	4,375	
1985.....	2,592	364	1,104	4,060	
1990.....	2,739	344	1,043	4,126	
1995.....	3,004	376	1,107	4,487	
2000.....	3,507	431	1,255	5,193	
2005.....	4,131	499	1,401	6,031	
2010.....	4,664	557	1,531	6,753	
2015.....	4,976	590	1,639	7,205	
2020.....	5,065	597	1,709	7,372	
2025.....	4,932	580	1,706	7,218	
2030.....	4,735	555	1,656	6,946	
2035.....	4,706	551	1,637	6,894	
2040.....	4,834	566	1,673	7,073	
2045.....	5,001	585	1,730	7,316	
2050.....	5,046	591	1,756	7,392	
2055.....	5,032	589	1,757	7,377	
2060.....	5,066	595	1,764	7,422	
Alternative II-B:					
1982.....	2,723	418	1,232	4,374	
1985.....	2,592	364	1,104	4,061	
1990.....	2,746	345	1,046	4,138	
1995.....	3,003	376	1,107	4,486	
2000.....	3,506	431	1,255	5,191	
2005.....	4,128	499	1,401	6,028	
2010.....	4,660	557	1,530	6,748	

TABLE A4.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF JUNE 30 BY ALTERNATIVE, CALENDAR YEARS 1960-2060 (Cont.)
[In thousands]

Calendar year	Dependents of disabled workers			Total
	Disabled workers	Wives and husbands	Children	
Alternative II-B: (Cont.)				
2015	4,970	590	1,637	7,198
2020	5,057	597	1,707	7,361
2025	4,923	579	1,704	7,207
2030	4,726	554	1,654	6,934
2035	4,696	550	1,635	6,882
2040	4,825	565	1,671	7,061
2045	4,992	585	1,727	7,304
2050	5,036	590	1,754	7,380
2055	5,022	588	1,754	7,364
2060	5,056	592	1,761	7,410
Alternative III:				
1982	2,725	418	1,233	4,376
1985	2,603	366	1,109	4,079
1990	2,818	354	1,074	4,246
1995	3,194	400	1,120	4,714
2000	3,830	471	1,259	5,560
2005	4,585	554	1,371	6,510
2010	5,216	623	1,451	7,293
2015	5,583	662	1,514	7,759
2020	5,683	670	1,545	7,898
2025	5,518	648	1,517	7,683
2030	5,261	616	1,447	7,324
2035	5,168	605	1,400	7,172
2040	5,211	609	1,393	7,214
2045	5,241	613	1,397	7,252
2050	5,101	597	1,373	7,071
2055	4,897	573	1,327	6,796
2060	4,747	555	1,285	6,587

Note: The definitions of alternatives I, II-A, II-B, and III are presented in the text.

AVERAGE WAGES AND INFLATION

Future increases in the Consumer Price Index and in average wages will directly affect the OASDI program. In addition to the direct effect of higher wages on taxable payroll and on benefits subsequently based on that higher payroll, the automatic adjustment provisions in the law require that the benefit formula, the taxable earnings base, the exempt amount in the earnings test, and the amount of earnings required for a quarter of coverage be adjusted to reflect increases in average wages, and that benefit payments be adjusted to reflect increases in the CPI.

The ultimate real-wage differentials were based primarily on projections of historical trends. Both the analysis of these trends and the projections took into account productivity gains and the factors linking productivity gains with the real-wage differential. Over the last 30 years, annual increases in productivity have averaged 2.2 percent, the result of average increases of 1.2, 2.9, and 2.6 percent in each of the last, second-last, and third-last 10-year period, respectively. Meanwhile, the real-wage differential has averaged 1.2 percent over the last 30 years, the result of average increases of -0.5, 1.8, and 2.5 percent in each of the previously mentioned periods. The linkage between annual increases in productivity and the real-wage differential has averaged 1.0 percent over the last 30 years and 1.7 percent over the last 10 years. The linkage reflects changes in such factors as the average number of hours worked per year, the extent to which employees share in the returns of production, and the proportion of employee compensation paid as wages.

The ultimate annual increases in productivity are assumed to be 2.8, 2.5, 2.2, and 1.9 percent for alternatives I, II-A, II-B, and III, respectively. The corresponding ultimate annual improvements in the linkage were assumed to be 0.3, 0.5, 0.7, and 0.9 percent. The resulting ultimate real-wage differentials were 2.5, 2.0, 1.5, and 1.0 percent.

In alternative II-A, the CPI was assumed to increase ultimately at an annual rate of 3 percent. In alternative II-B, the CPI was assumed to increase ultimately at an annual rate of 4 percent, which is slightly lower than the average of 4.3 percent experienced over the last 30 years. The ultimate increases in the average annual CPI under alternatives I and III of 2 percent and 5 percent, respectively, were chosen to include a reasonable range of possible values.

The ultimate increases in average annual wages in covered employment were assumed to be 4.5, 5.0, 5.5, and 6.0 percent, for alternatives I, II-A, II-B, and III, respectively. These were obtained by adding the corresponding annual percentage increases in the CPI to the assumed real-wage differentials for each alternative.

AVERAGE BENEFITS

Future increases in the amount of the average retired-worker benefit awarded were projected by simulating the automatic benefit adjustment provisions and calculating future benefits for workers, by sex, at various earnings levels. Future increases in the average male and female retired-worker benefits in current-payment status were projected on the basis of the distribution of current beneficiaries by year of award, their average awarded benefits, and the increase in their benefits since the year of award. The average male and female disabled-worker benefits were projected similarly.

The average benefits for all persons receiving OASI or DI monthly benefits based on the earnings records of male workers (except recipients of residual payments to wives, widows, husbands, and widowers) were projected to increase at the same rate as the average male retired-worker or disabled-worker benefit, respectively. Similarly, the average benefits for all persons receiving OASI or DI monthly benefits based on the earnings records of female workers were assumed to increase at the same rate as the average female retired-worker or disabled-worker benefit, respectively.

BENEFIT PAYMENTS

For each category of beneficiary, monthly benefit payments were calculated as the product of the number of beneficiaries and the corresponding average benefit. These amounts were then adjusted to include retroactive payments to newly awarded beneficiaries. Retroactive payments are made for months of entitlement between the date of filing for benefits and the date of first payment as well as for up to 6 months (or 12 months for disabled widows and widowers and for all DI beneficiaries) prior to the date of filing during which eligibility requirements are satisfied, but only if benefits are not thereby permanently reduced for early entitlement. Average retired-worker benefits were further adjusted to account for projected variations in the age distribution of retired-worker beneficiaries at initial entitlement.

Lump-sum death payments were calculated as the product of the number of such payments (which was projected by applying the assumed mortality rates to the projected fully insured population) and the amount of the lump-sum death payment (\$255).

ADMINISTRATIVE EXPENSES

The projection of administrative expenses through 1991 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 1991, administrative expenses were assumed to increase at approximately the compounded rate of the estimated increases in the number of beneficiaries and in average wages in covered employment.

RAILROAD RETIREMENT FINANCIAL INTERCHANGE

The effect of the financial interchange with the Railroad Retirement program was evaluated on the basis of trends similar to those used in estimating the cost of the OASDI benefits. The resulting effect was an average annual long-range cost to the OASDI system of 0.01 percent of taxable payroll.

REIMBURSEMENT FOR NONCONTRIBUTORY CREDITS

Reimbursement from the general fund of the Treasury for noncontributory credits for military service has not been reflected in the cost estimates. The reduction of cost resulting from such reimbursement is estimated to be about 0.05 percent of taxable payroll currently, and to decrease as a percentage of taxable payroll until about 2015, after which it is negligible.

Reimbursement from the general fund of the Treasury for special benefits paid to certain persons aged 72 and over has not been reflected in the cost estimates. The reduction in cost resulting from such reimbursement is estimated to be 0.01 percent of taxable payroll currently, and to decrease to a negligible amount after 1984.

APPENDIX B.—SENSITIVITY ANALYSIS

This appendix illustrates the sensitivity of the medium-range and long-range cost estimates to changes in selected individual assumptions. Although the estimates under the four alternatives illustrate the variations in the projected OASDI cost resulting from different combinations of assumptions, they do not show the variations resulting from changes in any single assumption. In the sensitivity analysis, one of the alternatives (II-B) is selected to be the starting set of assumptions. For each sensitivity test, only one assumption within that alternative is varied, and the resulting range of cost rates is estimated. Similar variations in the selected assumptions within the other alternatives would result in similar variations in cost rates (when expressed as percentage variations in those rates).

TOTAL FERTILITY RATE

Table B1 shows the estimated average annual OASDI cost rate under alternative II-B with various assumed ultimate total fertility rates. Those rates are 1.7 children per woman (as in alternative III), 2.0, 2.1 (as in alternatives II-A and II-B), and 2.4 (as in alternative I). The rates are assumed to change gradually from their current levels and to reach their ultimate values in 2005.

TABLE B1.—ESTIMATED AVERAGE ANNUAL OASDI COST RATE UNDER ALTERNATIVE II-B WITH VARIOUS FERTILITY ASSUMPTIONS
(As percent of taxable payroll)

Calendar years	Ultimate total fertility rate ^a			
	1.7	2.0	2.1	2.4
1982-2006	11.37	11.37	11.37	11.37
2007-2031	14.78	14.25	14.08	13.62
2032-2056	19.81	17.46	16.81	15.04
1982-2056	15.32	14.36	14.09	13.34

^aThe total fertility rate for any year is the average number of children who would be born to a woman in her lifetime if she were to experience the birth rates by age observed in, or assumed for, the selected year, and if she were to survive the entire child-bearing period. Ultimate rates are assumed to be attained by 2005.

Note: The definitions of alternative II-B, cost rate, and taxable payroll are presented in the text.

Over the medium-range period, the average cost rate is 11.37 percent of taxable payroll under the four fertility assumptions. By contrast, the average long-range cost rate varies over a wide range, from 13.34 to 15.32 percent.

During the medium-range period, changes in fertility affect the working population only slightly and result in relatively minor changes in the number of child beneficiaries. Hence, the program cost is affected only slightly. Later in the 75-year period, however, under higher fertility, the labor force increases faster than the beneficiary population, so that the average long-range cost rate decreases with increasing fertility.

MORTALITY

Table B2 shows the estimated average annual OASDI cost rate under alternative II-B with various assumptions about future mortality improvement, as measured by the percentage decrease from 1978 to 2060 in the age-sex-adjusted death rate. Those assumptions are that mortality will improve by about 22 percent (as in alternative I), 37 percent (as in alternatives II-A and II-B), and 59 percent (as in alternative III).

TABLE B2.—ESTIMATED AVERAGE ANNUAL OASDI COST RATE UNDER ALTERNATIVE II-B WITH VARIOUS MORTALITY ASSUMPTIONS
[As percent of taxable payroll]

Calendar years	Mortality improvement ¹		
	22 percent	37 percent	59 percent
1982-2006.....	11.20	11.37	11.70
2007-2031.....	13.44	14.08	15.42
2032-2056.....	15.54	16.81	19.53
1982-2056.....	13.40	14.09	15.55

¹The mortality improvement is the percentage decrease from 1978 to 2060 in the age-sex-adjusted death rate.

Note: The definitions of alternative II-B, cost rate, and taxable payroll are presented in the text.

Over the medium-range period, the average cost rate increases with increasing mortality improvement from 11.20 percent of taxable payroll (for 22 percent mortality improvement) to 11.70 percent (for 59 percent improvement). Over the long-range period, a similar but more pronounced trend exists. The average long-range cost rate increases from 13.40 to 15.55 percent.

The average cost rate increases with increasing improvement in mortality because of the relationship between age and mortality. Any mortality improvement in the population over age 65, where mortality rates are the highest, extends the length of time that retirement benefits are paid. At ages 50-64, mortality improvement results in an increase in tax income, but this is more than offset by the resulting increase in benefits payable to the additional retirees at age 65. At ages 20-49, mortality rates are so low that even substantial improvement in the rates would not result in significant increases in the number of covered workers. Mortality improvement at ages under 20 has relatively little long-term effect on the relationship between income and outgo. Consequently, the net effect of mortality improvement is to increase outgo more than taxable income, thereby resulting in higher cost rates.

DISABILITY INCIDENCE RATES

Table B3 shows the estimated average annual OASDI cost rate under alternative II-B with various disability incidence rate assumptions. Those assumptions are that the ultimate disability incidence rates by age and sex will differ from the average rates by age and sex experienced in 1979-81 as follows: they will be about the same (as in alternative I), about 15 percent higher (as in alternatives II-A and II-B), and about 30 percent higher (as in alternative III). The rates are assumed to change gradually from their current levels and to reach their ultimate values in 2001.

TABLE B3.—ESTIMATED AVERAGE ANNUAL OASDI COST RATE UNDER ALTERNATIVE II-B
WITH VARIOUS DISABILITY INCIDENCE ASSUMPTIONS
(As percent of taxable payroll)

Calendar years	Disability incidence rate increase ¹		
	None	15 percent	30 percent
1982-2006	11.30	11.37	11.44
2007-2031	13.89	14.08	14.26
2032-2056	16.62	16.81	16.99
1982-2056	13.94	14.09	14.23

¹The disability incidence rate increase is based on the ratio of the age-sex-adjusted incidence rate in 2001 and later to such rate during 1979-81.

Note: The definitions of alternative II-B, cost rate, and taxable payroll are presented in the text.

Over the medium-range period, the average cost rate varies with changing disability incidence from 11.30 percent of taxable payroll (for no increase) to 11.44 percent (for 30 percent increase). Over the long-range period, it varies from 13.94 percent to 14.23 percent.

CONSUMER PRICE INDEX

Table B4 shows the estimated average annual OASDI cost rate under alternative II-B with various CPI assumptions. These assumptions are that the ultimate annual CPI increase will be 2 percent (as in alternative I), 3 percent (as in alternative II-A), 4 percent (as in alternative II-B), 5 percent (as in alternative III), and 6 percent. In each case the ultimate real-wage differential is assumed to be 1.5 percent, yielding ultimate percentage increases in average annual wages of 3.5, 4.5, 5.5, 6.5, and 7.5 percent, respectively. The annual CPI increase is assumed to change gradually from its current level and to reach its ultimate value in 1992.

TABLE B4.—ESTIMATED AVERAGE ANNUAL OASDI COST RATE UNDER ALTERNATIVE II-B
WITH VARIOUS CONSUMER PRICE INDEX ASSUMPTIONS
(As percent of taxable payroll)

Calendar years	Ultimate percentage increase in wages-CPI ¹				
	3.5-2	4.5-3	5.5-4	6.5-5	7.5-6
1982-2006	11.52	11.44	11.37	11.29	11.22
2007-2031	14.41	14.25	14.08	13.92	13.77
2032-2056	17.22	17.02	16.81	16.61	16.43
1982-2056	14.38	14.24	14.09	13.94	13.81

¹The first value in each pair is the assumed annual percentage increase in average wages in 1992 and later years. The second value is the assumed annual percentage increase in CPI in 1992 and later years. The assumptions used in earlier years gradually merge into the ultimate values.

Note: The definitions of alternative II-B, cost rate, and taxable payroll are presented in the text.

Over both the medium-range and long-range periods, the average cost rate varies as the assumed rate of change in the CPI increases. Over the medium range, the average cost rate decreases from 11.52 percent of taxable payroll (for CPI increases of 2 percent) to 11.22 percent (for CPI increases of 6 percent). Over the long range, it varies from 14.38 percent to 13.81 percent.

The relationship described above results primarily from the time lag between the effect on income and on benefit outgo. When assuming a higher rate of increase in the CPI (in conjunction with a constant real-wage differential), the effect on income of the implied higher rate of increase in wages is experienced immediately, while the effect on benefits of the higher rate of increase in the CPI is experienced with

about a half-year lag. In addition, the earliest effect on benefits of the higher rate of increase in wages is experienced with about a 2-year lag.

REAL-WAGE DIFFERENTIAL

Table B5 shows the estimated average annual OASDI cost rate under alternative II-B with various real-wage assumptions. These assumptions are that the ultimate real-wage differential will be 1 percent (as in alternative III), 1.5 percent (as in alternative II-B), 2 percent (as in alternative II-A), and 2.5 percent (as in alternative I). In each case the ultimate annual CPI increase is assumed to be 4 percent, yielding ultimate percentage increases in average annual wages of 5, 5.5, 6, and 6.5 percent, respectively. The real-wage differential is assumed to change gradually from its current level and to reach its ultimate value in 1992.

TABLE B5.—ESTIMATED AVERAGE ANNUAL OASDI COST RATE UNDER ALTERNATIVE II-B WITH VARIOUS REAL-WAGE ASSUMPTIONS
(As percent of taxable payroll)

Calendar years	Ultimate percentage increase in wages-CPI ¹			
	5-4	5.5-4	6-4	6.5-4
1982-2006	11.78	11.37	10.98	10.62
2007-2031	14.98	14.08	13.26	12.50
2032-2056	18.03	16.81	15.73	14.72
1982-2056	14.93	14.09	13.32	12.62

¹The first value in each pair is the assumed annual percentage increase in average wages in 1992 and later years. The second value is the assumed annual percentage increase in CPI in 1992 and later years. The difference between the two values is the real-wage differential. The assumptions used in earlier years gradually merge into the ultimate values.

Note: The definitions of alternative II-B, cost rate, and taxable payroll are presented in the text.

Over the medium-range period, the average cost rate varies from 11.78 percent of taxable payroll (for real-wage differentials of 1 percent) to 10.62 percent (for differentials of 2.5 percent). Over the long-range period, it varies from 14.93 percent to 12.62 percent.

The average cost rate decreases with increasing real-wage differentials for two reasons. One is that there is a lag between the time when workers pay taxes based on the higher earnings and the time when they draw benefits based on those earnings. The other is that the benefits to those already eligible—benefits which increase according to the increase in the CPI, not wages—are smaller relative to the payrolls based on the higher real-wage differentials.